

**MICHIGAN ENVIRONMENTAL SCIENCE BOARD**

**DIRECTIONAL DRILLING PANEL MEETING SUMMARY**

**TUESDAY, SEPTEMBER 23, 1997**

**NATURAL SCIENCE BUILDING**

**ENTOMOLOGY CONFERENCE ROOM 244**

**MICHIGAN STATE UNIVERSITY**

**EAST LANSING, MICHIGAN**

**PANEL MEMBERS PRESENT**

Dr. David T. Long, Chair

Dr. William E. Cooper

Dr. William B. Harrison III

Dr. Ronald H. Olsen

Dr. Bette J. Premo

Mr. Keith G. Harrison, Executive Director

**DEQ/OSEP SUPPORT STAFF PRESENT**

Mr. Jesse Harrold, Environmental Officer

Ms. Patricia Hiner, Executive Secretary

Ms. Evelyn L. Thomas, Graduate Student Intern

**I. CALL TO ORDER**

Dr. David T. Long called the meeting to order at 9:21 am.

**II. INTRODUCTION OF PANEL MEMBERS**

Dr. Long asked each of the board members to introduce themselves.

Dr. Long (Department of Geological Sciences, Michigan State University - MSU) indicated that his background was working with the fluids, or brines, that are associated with the different geologic formations (Niagara, Dundee) from which the oil and gas are being drilled.

Dr. Ronald Olsen (University of Michigan - U of M) indicated that he was involved in a joint study between MSU and U of M that involved pumping water into the ground for bioremediation. This relates to the natural processes that can remediate any accidents, which can, and do, happen at drilling sites

Dr. William Harrison (Geology Department, Western Michigan University) indicated that he is currently serving as the director of the Michigan Basin Corp. Research Laboratory, which is devoted to the study of petroleum, geology, and the rock formations existing in the subsurface of the Michigan basin.

Dr. William Cooper (Zoology Department and Institute for Environmental Toxicology,

MSU) indicated that he is an ecologist who chaired the Michigan Environmental Review Board under Governors Milliken and Blanchard. He also ran hearings on Pigeon River and Nordhouse Dunes.

Dr. Bette Premo (Chief Executive Officer, White Water Associates) indicated that her background is in limnology, or fresh water ecology and chemistry; but she is also involved in work with wetlands, special areas, and endangered and threatened species.

Mr. Keith Harrison (Executive Director, Michigan Environmental Science Board - MESB), indicated that his background was in terrestrial ecology.

Dr. Long stated the charge given to the MESB by the Governor. The charge is to assess the impact of directional drilling on the Great Lakes. There are three particular directives to be addressed by the Panel: (1) Evaluate the risk of directional drilling causing contamination of the waters through releases of hydrocarbons through the subsurface directly to the lake bottom and shorelines to the Great Lakes, (2) Evaluate potential impacts of directionally drilled wells on competing uses of Great Lakes waters and shoreline areas, and (3) Review existing and potential permit conditions for adequacy in protecting the shoreline environment from adverse impacts.

### **III. EXECUTIVE DIRECTOR'S REPORT**

Mr. Harrison stated that the guest scientists on the Panel are Dr. Cooper and Dr. Harrison. The newspaper article announcing this meeting as a public hearing was in error, although public comment is accepted. It was reiterated that the MESB was a science board and that science and technology, rather than public policy making would be the focus of the Panel's investigation. Due to the short turn-around time and the other responsibilities of the Panel members, this would be the only meeting. After the deliberations today, writing assignments will be given to the various Panel members, and the material assembled, refined, and sent to the Director of the Department of Environmental Quality (DEQ) as per the Governor's instructions.

### **IV. PUBLIC COMMENT**

The meeting was opened up to public comment. Individuals wishing to speak were asked to state their name for the record.

Hal Fitch (Assistant Supervisor of Wells, DEQ) stated that there have been more than 2,000 wells directionally drilled in Michigan. A few have had bottom hole targets under inland lakes, and since 1979, thirteen had upland locations for the wellhead with drilling to bottom hole locations under the Great Lakes -- 10 under Lake Michigan, mostly in the Manistee area, and three under Lake Huron and Saginaw Bay.

Mr. Fitch indicated that the technology is still continuing to steadily change and improve. The maximum angle for directional drilling, depending on depth and formation is about 45 degrees in Michigan. The limit is due to mechanical difficulties, such as sticking of

the drill pipe on the side of the hole due to differential pressure. Also, there is keyholing, or enlargement, of the drill hole due to abrasion from the drill pipe. These are problems with well completion, not an environmental risk. In horizontal drilling, a type of directional drilling, the hole goes from either vertical or an angle to a horizontal attitude. These horizontal extensions which are limited primarily by economics, have been up to five to eight miles long. These lengths are not presently expected in Michigan, but are possible.

Mr. Fitch stated that directional holes are quite similar to conventional vertical wells. First, the drill site is chosen. With directional drilling there is more latitude to find the optimum spot. Then a one-to-three-acre drill pad is cleared and leveled. The rig sets up and starts drilling a surface hole, vertically to avoid cave-ins, going 100 feet below the deepest fresh water aquifers. A surface casing is set at that depth. Rated and pressure-tested pipe is set and cemented in place with the cement circulated down the inside of the pipe and up the outside back up to the ground surface. After the cement cures for a minimum of 12 hours to reach adequate compressive strength, blowout preventers are set on the casing and tested to maximum anticipated pressure. Next is the intermediate hole, and at any time the hole might be deviated, depending on the depth and location of the target. Although the intermediate hole ends in competent rock, because it goes through formations of varying permeabilities, it is cased and cemented similar to the surface hole. Bore preventers are attached to the top of the casing and are pressure tested. The hole then proceeds to drill the total depth. Upon hitting the Niagaran reef, only found maybe 30 percent of the time, production (additional strength) casing is used around, and generally through, the bottom of the hole. It is cemented in, perforated, and the well is ready to be tested and go on production. For a horizontal drainhole, the horizontal leg is completed as an open hole.

Dr. Cooper asked how oil companies determine where to drill. Mr. Fitch responded that most Niagaran drilling is in structures contiguous to known upland structures. With 3-D seismic, they can identify out laterally some distance. With regard to the lakeshore, there should not be interest much more than a mile out, but if technology changes that will have to be reevaluated. Economics are a controlling factor and there are not big reserves involved in the Great Lakes as there are in the Gulf of Mexico. Dr. Cooper reported that the well in Saginaw bay was described as a \$400 million hit for natural gas. However, it was pointed out that this amount was not clear profit and that well problems could result in only a small portion of those reserves being recovered. Dr. Harrison mentioned that there is a finite distribution of these reservoirs within a belt of Niagaran reefs that is only 10 to 15 miles wide and does not extend far offshore.

Mr. Fitch continued by stating that if a reservoir is not hit, the well is plugged. However, up to six or seven laterals can be run off one vertical hole, with the dry holes plugged at prescribed intervals back to the junction. If productive, the well produces a mixture of oil, gas and brine that go to a production facility to be separated. Oil is trucked or piped out, gas is compressed and installed in a pipeline, and the brine is trucked or piped to an approved disposal well. With adequate volume and pressure, productive wells can flow naturally or a variety of pumps can be used. Plugging is done immediately for a

dry hole or after the reserves are depleted. Cement, placed at prescribed intervals prevents migration of fluids, and a cement cap is placed at the top. Casings are cut off and the site is restored to its original contour and revegetated. Mr. Fitch also indicated that there were extensive evaluations that regulate and limit spills and losses and dictate containment procedures.

Keith Schneider (Michigan Land Use Institute) indicated that the Niagaran reef is a known source of hydrogen sulfide gas, with previous injuries and evacuations in the Manistee area. He also stated that his group had prepared a coastal energy development plan, with more strict coastal regulations to protect valuable resources. Mr. Schneider was also concerned with the legality of the current lease sales under the Great Lakes Submerged Lands Act. He felt that the local units of government had not been given their rightful voice in consideration of these leases and their possible shoreline impact.

Paul Parks indicated that he was a retired engineer with 40 years experience in plant engineering. He stated that various sources had said that directional drilling was about as safe as regular vertical drilling. He then cited a list from the Michigan Environmental Council of 16 vertical well accidents in Michigan from 1980 - 1997. With blowouts, valve failures, fires, etc. vertical drilling is not safe and so neither is directional drilling. He portrayed the existing wells under Lake Michigan as a ticking time bomb, waiting for an accident. He stated that existing dikes are inadequate, and he was concerned that the rock formations might not be as contiguous as portrayed. He also said that a risk analysis would show a benefit of a few dollars for the state with incalculable risks.

Dr. Harrison responded that the rock materials are not similar to California or Alaska. There are not fractures, and seismic data, upon which the oil companies base their exploration, show the rock surfaces are contiguous for tens or hundreds of miles. The borehole is the only conduit to the surface, and there are ways to test for the integrity of the casing. The solid rock has a higher density in breaking strength than concrete, and there are no existing forces that will cause the rock to break on its own. There is not differential pressure, and there is protection against seepage at the interface between the rock formation and whatever is above it since the casing goes down into the rock formation. Dr. Cooper verified that this meant that a possible environmental episode would not be an aquatic problem where nothing could be done; but would likely happen on land where there were responses available.

Timothy Brock indicated that he was a professional engineer. He spoke on the adequacy of the well casing and the cementing to protect the environment. He also stated that there are no abnormally pressured zones known to exist in this area, and concluded that drilling under the Great Lakes bottomlands would not be harmful. Mr. Harrison asked if he would provide the Panel with data to back up what he stated. He said that he would be able to get that to the Panel. Dr. Harrison suggested starting with the calculations based on the planned gauge steel, the cement, and the rock, and how those calculations match with conventional practice.

Michael Barrett (Newstar Energy) defined “ferocity” as the ability for rock to contain fluid within itself, whereas “permeability” is the ability for that rock to pass that fluid within pore throats, or connections between the pores. He illustrated the layers of rock to be drilled through, starting with a covering of glacial drift which is a series of sands and clays from which comes much of the fresh water. Below this are the shales and carbonates with very low ferocity and very low permeabilities, acting as seals. In the deeper horizons at about 2,000 feet is the Traverse limestone containing some ferocity zones, but not in Manistee County. Below that is the Dundee, the Detroit River series, with a series of impermeable salt beds. Mr. Barrett added that there are great costs incurred in the design and the drilling in order to protect the environment, but that the rocks also provide a safety measure to protect the waters. Lake Huron also has approximately the same substructure.

Dr. Premo questioned the degree of confidence in the permeability and porosity of the rock formations given the variety between locations. Dr. Harrison responded that it can be directly measured at each borehole for a high degree of precision in every well, and nearby wells can give good predictive data.

Paul McConnell (University of Oklahoma) spoke about surface facilities. Once a successful oil and gas well is drilled, wells are drilled in the ground water to delineate the flow direction for placement of permanent monitors. This is the result of a joint effort between the industry and the DEQ. In response to questioning by Dr. Olsen, Mr. McConnell said that ground water flow near a large body of water is generally towards it. The speed of flow is variable with 100 feet/year being considered a fast rate. To prevent contamination, all equipment in an oil/gas facility that is going to have contact with the liquid components of hydrocarbon production will have a liner. In hydrocarbon storage, the liner will have the holding capacity of one and a half times the volume of the vessel. The ground monitor is just downgrade, which will be checked biannually to determine leakage. Formerly, when tank barriers were built on top of sand, there were more spills, which went into ground water; but there has not been a problem with pollution of the ground water since the new rules went into effect.

Dr. Cooper brought up the accident at Pigeon River, with which Mr. McConnell was not familiar. According to Dr. Cooper, it was human error rather than a design fault. Mr. McConnell, indicated that if an accident happens now, the industry is more knowledgeable about ground water flow and water quality, and can take more immediate steps to clean up a problem when it is discovered. He stated that there are really no extra precautions taken when drilling under the Great Lakes. They have been drilling under lakes since the 1970's.

Mr. McConnell was questioned about onsite storage of residual drilling material. He replied that although this was done sometimes, the Newstar permit provided for disposal in a landfill. Dr. Cooper noted that this would be a regular landfill, and not an Act 64 hazardous material landfill, which is not available. Mr. McConnell replied that the drilling muds which contained small amounts of hydrocarbons and chlorides were not more hazardous than typical landfill components. This is the current method for

handling the waste from most wells near the lake. He also indicated that residue releases are fairly easy to see, provided that the pipes are above ground and not buried. Although various interests are involved in drilling operations, pipelines are commonly put above ground for observation, maintenance, and security. Within an oil/gas facility, all pipe is above ground for inspection, but with long distances (cross-country), that might not be feasible.

Dr. Cooper asked about the special precautions taken with a sour well and the possibility of a sour well sharing lines with one that is not. Mr. McConnell responded that the rules were completely different for sour gas wells with softer steel for the pipes and more strict monitoring procedures. Sharing of pipelines for transmission would cause the entire product to be sour, albeit less concentrated. Sour gas would have to be taken through a sweetening plant, but otherwise, new wells could be potentially piggybacked to existing pipelines limiting roads and pipelines on the surface. All gas rated for sale in the Manistee area now goes into one pipeline.

Dr. Harrison cautioned about making distinctions between directional and vertical wells. For technical and other purposes they are virtually the same. Dr. Long indicated that the distinction should be between drilling next to the Great Lakes versus other places. Dr. Harrison added that although the Great Lakes contain a greater volume of water than inland lakes, wetlands or rivers, drilling under any body of water is a concern. Dr. Cooper disagreed in that Lake Michigan has a two to three hundred year turnover time of water, and a mistake in the Great Lakes would persist much longer than in a smaller lake. The scale of both the impact and the cost involved is much greater.

Bill Myler (President of Muskegon Development Company, Vice Chair of the Michigan Oil and Gas Association and Governor's appointee to the Interstate Oil and Gas Compact Commission) verified the accuracy of previous presenters. He reported that he had a high degree of confidence in the industry and current drilling methods. When asked about the impact of fragmentation of the habitat through roads and pipelines, he replied that for a certain county 85 percent of their pipelines went along existing roads, tracks, power and gas lines. Dr. Cooper added that an advantage to directional drilling was more flexibility; the rigs could be placed where there was existing development rather than on virgin real estate. He questioned the extent it was possible to use existing wellheads and drill laterally. Dr. Harrison replied that this was being done in some cases, and Mr. Myler added that this needed to be looked at on a case by case basis to see if it made sense.

Mr. Myler stated that over two-thirds of the wells have been in private land, much of it farm land, where the landowners have profited and been happy to participate. He felt the industry has well managed the need to be conscious of both land use and the need for hydrocarbons. Of the nine million people in Michigan, he calculated that 8.8 million of them never see, hear, or smell an oil well, yet they benefit from the use of the oil and gas.

Robert Grooters (citizen) stated that he had been tracking the oil and gas story in

Michigan since the mid 1970's. His concern was with the effect of the unknown and its impact on both technology and time. He indicated that the lease contracts between oil companies and Michigan are imperfect in that there are no strict limits on the time of the contract. The limits are imposed by production quotas, which are not well defined either. There is also a loss of control, since leases can be assigned in succession. He indicated that companies can produce in any formation, going from one to another. The lease is based on the original formation and there is no bonus for other formations, which could be huge. There is no ability for the state to reformulate environmental priorities or economic realities. These royalty rates which are set today could be still in force 30 years from now when the rates have greatly increased everywhere else. Mr. Grooters characterized oil exploration in Michigan as being at an experimental stage with possible implications as large as bringing large ships onto the Great Lakes with the resulting zebra mussel disaster.

Everett Kinney (Commissioner and Councilman from Harrisburg, Ottawa County) spoke regarding Lake Michigan as the source of their water supply. Having seen the failure of fail-safe systems, he was concerned with what he saw as the inevitable failure of a drilling operation with the subsequent release of oil into Lake Michigan. This probability of failure will only be increased if the present drilling is successful. He stated that even the millions of dollars of proposed revenue would not be compensation for spoilage of such an invaluable natural resource.

Julie Stoneman (Michigan Environmental Council) expressed concern with land use conflicts. In particular, there are thousands of acres of sand dunes, which have been recommended for inclusion in the critical dunes designation that would prohibit hydrocarbon development facilities. She stated that these dunes should be protected regardless of their official designation. She also cautioned that formations that are not now feasible to explore could become so in the future, producing additional impacts.

Dr. Cooper asked for clarification on the extent of the potentially impacted area. If the Niagaran reefs are only 15 miles long, that is not much shoreline, especially if much of it is already developed. Dr. Harrison explained that the width of these reefs and not the length is 15 miles. Also, it is a different geology in Lake Huron and the total potential is not defined. None of the other formations that produce oil and gas have the same defined geometric restrictions that the Niagaran trend does. Mr. Fitch used his diagram of Michigan to point out the formations and the areas of interest for drilling. The Prairie du Chien reservoirs are widely scattered and the density of well development is less with one well for 640 acres.

Bill Bobier (State Representative) reminded the Panel of the precedent that their scientific work would provide. He stated that while the oil industry had improved greatly in environmental concerns, it had been reluctant to do so when cost was involved. He called for utilization of all the resources available, including the Michigan Resource Inventory System for identification of endangered species and the input of local authorities for their expertise in topography and community impact issues.

Randy Parsons (Oil and Gas Industry representative) presented literature on the subject to the Panel.

Tanya Cabala (Lake Michigan Federation) Indicated that she was concerned about the prospect of proliferation of oil drilling sites on Lake Michigan. The shoreline is degrading for a number of reasons with both habitat destruction and economic impacts and many people are concerned. Ms. Cabala inquired about the record of the Newstar, but was informed by Mr. Harrison that this was not within the Panel's charge. She also suggested that the Panel visit the communities involved to get a personal look rather than just looking at it from a purely scientific view. Mr. Harrison indicated that the Governor had specifically asked for input from the MESB because of its collective scientific and technological expertise and did not request that it evaluate the issue from a personal perspective.

## **V. PANEL DISCUSSION**

Dr. Cooper expressed concern that directional drilling is a new technology. Drilling at a right angle provides new possibilities for locating oil and gas. He stated that expanded costs should not prevent additional safeguards to protect the Great Lakes. Another concern is the differing ecologies, which should have different permit conditions. Lake Michigan has sand dunes where setbacks make drilling possible within 3,000 to 4,000 feet. On the Lake Huron side of the state there are floodplains with wetlands extending 30 miles and more making setbacks impossible.

Discussed at length was the extent of the possible impact of drilling in Michigan. While the Niagaran reef is fairly concentrated, there are Prairie du Chien formations scattered across a wide area. It was brought up by Mr. Fitch that there are varying degrees of interest in different formations at different times. Dr. Long inquired about the possibility of a projection of what areas might be potential spots for development during the next 10 years. Mr. Fitch thought that five or six years might be more realistic and that Niagaran was the main focus with scattered locations for Prairie du Chien.

One suggestion was that leases should be restricted to a single strata; perhaps restricted to the Niagaran until the surface impacts of drilling to other formations are better defined. Also, the DNR and the DEQ should work closely together on potential permits and leases. Another suggestion was a mandate for the use of existing roads, pipelines, and sweetening facilities for new developments. This would be even more of a concern on the Lake Huron side of the state where the drilling is not as concentrated. Dr. Harrison stated that industry is already doing this when possible for economic reasons, even on the eastern side of the state. It is more costly, not just environmentally problematic, to make new roads, pipelines, etc.

Dr. Olsen asked whether drilling into the different formations was really any different. Dr. Cooper responded that the actual drilling was the same, the difference was in the ecological surface impact as the Prairie du Chien reservoirs were so widely scattered.



Dr. Harrison inquired about the horizon restriction on the leases and whether similar standards should be applied throughout the system, or whether a unique set of standards ought to be maintained for a few wells along the coast. In consideration of the need to protect the coastal zone, Dr. Premo asked about the availability and/or adequacy of environmental impact assessments (EIA) prior to drilling. Dr. Cooper pointed out that while an environmental impact assessment might be done, there was no mandate to address all ecological issues that might be raised. While endangered species, wetlands, and sand dunes were protected, there is no mandate, for example, to deal with concerns such as local land use and forest fractionation.

Dr. Long brought the discussion back to the three charges from the Governor. It was generally agreed that the technology below ground was acceptable, that there is no additive factor to slant drilling as opposed to vertical. The second charge deals with potential impacts on competing land uses. This is a more subjective area with less data and more issues such as aesthetics and perception. Local interest is often colored by the potential for or loss of monetary gain. The frequency of land use was also seen to be a factor. Industry, forest, and recreational needs often conflict and there needs to be a coherent pattern of development for effective compromise. It was warned that without leadership, local demands could lead to unrealistic restrictions. It was clarified that surface locations for drilling was the primary issue, with areas needing to be protected including sand dunes, state parks, and wetlands. Mr. Harrison indicated that a thorough consideration of the first two charges would provide the basis for addressing the third charge, which is for the Panel to address the adequacy of existing and potential permit conditions to protect the environment.

The issue of drilling waste storage was discussed. There will be temporary storage of oil and brine. There are also drilling muds. These are primarily inert rock cuttings mixed with some chloride. These do not need to be removed as the cuttings are identical to the glacial drift material already present and the chloride is only present in small amounts and is fairly immobile. All cuttings are dissolved and all of the clear fluids pumped off the pit (into a brine disposal well) before the pit is encapsulated. The volume of material accumulated during drilling was estimated to be one to two hundred cubic yards. Mr. Fitch verified that there was not a problem with accumulation of radioactive material in the wells under consideration. Also liners for storage pits have been required since 1981, and these requirements have been steadily upgraded. While the polyvinyl chloride (PVC) has been known to deteriorate if exposed to ultraviolet radiation, this is not a problem in the ground.

The historical problems associated with drilling were discussed. It was brought out that procedures have changed dramatically during the past two decades and that some of the problems that did occur were due to practices that no longer exist. Mr. Fitch said that a catastrophic spill was the biggest concern, but Dr. Cooper argued that the accumulative effects of a small, undetected volume would have a greater impact. In any case, it is the owner of the permit who is liable and responsible for anything associated with that operation. Mr. Jack Westbill (Michigan Oil and Gas News) reported that he had reports on spills and incidents since 1940. These have been compiled into a readily accessible form for the past 10 years. Mr. Harrison requested

that the information be provided to the Panel.

Dr. Cooper reminded everyone of the October 8 deadline. While this might seem too fast for such complex problems, these are not new issues, but rather issues that many of the Panel members have been facing and dealing with for years. Industry is under economic pressure to move quickly and realistically, and they should not be held back without reason. There is only a small window of opportunity to advise the DEQ and the Governor, and to let that chance pass by is to give up any possible impact on the final product. If there is no action, there is no chance for improvement.

#### **IV. NEXT MEETING DATE**

No additional meetings were scheduled.

#### **V. ADJOURNMENT**

The meeting was adjourned at 12:56 PM.

Respectfully submitted,  
Keith G. Harrison, M.A., R.S., Cert. Ecol.  
Executive Director  
Michigan Environmental Science Board